

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (currently amended) A method of making a stabilized transition alumina catalyst support comprising:

(a) introducing ~~to a transition alumina~~ by impregnation at least one structural stabilizer precursor to a transition alumina comprising a phase selected from the group consisting of γ -Al₂O₃, δ -Al₂O₃, θ -Al₂O₃ and any combination thereof, to provide a stabilizer-impregnated alumina; and

(b) optionally, drying the stabilizer-impregnated alumina;

(c) steaming the stabilizer-impregnated alumina at conditions sufficient to at least partially transform the stabilizer-impregnated alumina to at least one phase selected from the group consisting of boehmite, pseudoboehmite, and combination thereof and to form a stabilizer-containing boehmite alumina, wherein said sufficient conditions comprise a temperature between 180° C and 300° C; and

(d) calcining the stabilizer-containing boehmite alumina at a temperature between 400° C and 900° C to form a stabilized transition alumina catalyst support comprising a γ -Al₂O₃ phase and a pore volume from 0.2 cm³/g to 0.6 cm³/g.

2-19. (canceled)

20. (currently amended) A method of making a stabilized transition alumina catalyst support comprising:

(a) steaming a transition alumina comprising a phase selected from the group consisting of γ -Al₂O₃, δ -Al₂O₃, θ -Al₂O₃ and any combination thereof, said steaming being carried out at conditions sufficient to at least partially transform the transition alumina to at least one phase selected from the group consisting of boehmite,

pseudoboehmite and combination thereof, and to form a boehmite alumina, wherein said sufficient conditions comprise a temperature between 180° C and 300° C;

(b) introducing by impregnation to the boehmite alumina at least one structural stabilizer precursor to provide a stabilizer-containing boehmite alumina;

(c) optionally, drying the stabilizer-containing boehmite alumina; and

(d) calcining the stabilizer-containing boehmite alumina at a temperature between 400° C and 900° C to form a stabilized transition alumina catalyst support, said stabilized transition alumina catalyst support comprising a γ -Al₂O₃ phase and a pore volume ranging from 0.2 cm³/g to 0.6 cm³/g.

21. (canceled)

22. (original) The method according to claim 20 wherein the transition alumina comprises a γ -Al₂O₃ phase.

23. (currently amended) The method according to claim 20 wherein the stabilized transition alumina further comprises ~~a phase of γ -Al₂O₃, δ -Al₂O₃, θ -Al₂O₃ or any combination thereof.~~

24-26. (canceled)

27. (original) The method according to claim 20 wherein the sufficient conditions of step (a) comprise a water vapor partial pressure between 1 bar and 5 bars.

28. (original) The method according to claim 20 wherein the sufficient conditions of step (a) comprise a water vapor partial pressure between 2 bars and 4 bars

29. (currently amended) The method according to claim 20 wherein the sufficient conditions of step (a) comprise ~~a temperature between 150° C and 500° C;~~ a water vapor partial pressure between 1 bar and 5 bar; and an interval of time between 0.5 hours and 10 hours.

30. (canceled)

31. (original) The method according to claim 20 wherein the at least one structural stabilizer precursor comprises at least one element selected from the group consisting of boron, magnesium, silicon, calcium, titanium, chromium, manganese, iron, cobalt, nickel, copper, zinc, gallium, strontium, zirconium, barium, selenium and the lanthanides, including lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium.

32. (original) The method according to claim 20 wherein the at least one structural stabilizer precursor comprises at least one element selected from the group consisting of boron, cobalt, zirconium, and combinations thereof.

33. (original) The method according to claim 20 wherein at least two structural stabilizer precursors are introduced to a boehmite alumina.

34. (canceled)

35. (original) The method according to claim 20 wherein the at least one structural stabilizer precursor is introduced in a manner and an amount effective for delivering an amount of structural stabilizer precursor between 0.1% and 20% by weight of structural stabilizer precursor relative to a final weight of the stabilized transition alumina.

36. (original) The method according to claim 20 wherein the at least one structural stabilizer precursor is introduced in a manner and an amount effective for delivering an amount of structural stabilizer precursor between 1% and 10% by weight of structural stabilizer precursor relative to a final weight of a stabilized transition alumina.

37. (original) The method according to claim 20 wherein the at least one structural stabilizer precursor is introduced in a manner and an amount effective for delivering an amount of

structural stabilizer precursor between 1% and 5% by weight of structural stabilizer precursor relative to a final weight of the stabilized transition alumina.

38. (original) The method according to claim 20 wherein the method includes step (c), and wherein step (c) comprises a temperature between 50° C and 200° C.

39. (original) The method according to claim 38 wherein step (d) is executed after step (b).

40-41. (canceled)

42. (currently amended) A method for making a stabilized transition alumina catalyst support and preparing a Fischer-Tropsch catalyst supported on said stabilized transition alumina catalyst support,
said method comprising the following steps for making a stabilized transition alumina catalyst support:

(i) steaming a transition alumina comprising a phase selected from the group consisting of γ -Al₂O₃, δ -Al₂O₃, θ -Al₂O₃ and any combination thereof, said steaming step being carried out at conditions sufficient to at least partially transform the transition alumina to at least one phase selected from the group consisting of boehmite, pseudoboehmite and combination thereof, and to form a boehmite material, wherein said sufficient conditions comprise a temperature between 180° C and 300° C;

(ii) before or after the steaming step (i), ~~incorporating~~ impregnating at least one structural stabilizer ~~into the catalyst support~~, whereby a stabilizer-containing boehmite alumina is generated from steps (i) and (ii); and

(iii) then calcining the stabilizer-containing boehmite alumina at a temperature between 400° C and 900° C to yield the stabilized transition alumina catalyst support, said stabilized transition alumina catalyst support comprising a γ -Al₂O₃ phase and a pore volume from about 0.2 cm³/g to about 0.6 cm³/g; and

said method further comprising the following steps for making the Fischer-Tropsch

catalyst:

(a) introducing at least one catalytic metal precursor to the stabilized transition alumina catalyst support of step (iii) to provide a catalyst-impregnated support;

(b) optionally, introducing at least one cocatalytic metal precursor to the catalyst-impregnated support to provide a cocatalyst-impregnated support;

(c) optionally, introducing at least one promoter precursor to the cocatalyst-impregnated support to provide a promoter-impregnated support;

(d) optionally, drying the catalyst-impregnated support at conditions effective for removing any solvents used in introducing at least one of the precursors of steps (a), (b) and (c), wherein drying provides a dried catalyst-impregnated support; and

(e) calcining the catalyst-impregnated support at conditions effective for decomposing at least one of the precursors of steps (a), (b) and (c) to the corresponding oxides.

43. (original) The method according to claim 42 wherein the at least one catalytic metal precursor comprises at least one metal selected from the group consisting of cobalt, iron, ruthenium and nickel.

44. (original) The method according to claim 42 wherein the at least one catalytic metal precursor comprises cobalt.

45. (original) The method according to claim 42 wherein the at least one catalytic metal precursor is added in an amount sufficient for delivering an amount of catalytic metal to the stabilized transition alumina catalyst support that is between 5% and 50% by weight of catalytic metal relative to a weight of the support.

46. (original) The method according to claim 42 wherein the at least one catalytic metal precursor is added in an amount sufficient for delivering an amount of catalytic metal to the stabilized transition alumina catalyst support that is between 10% and 40% by weight of catalytic metal relative to a weight of the support.

47. (original) The method according to claim 42 wherein the at least one catalytic metal precursor is added in an amount sufficient for delivering an amount of catalytic metal to the stabilized transition alumina catalyst support that is between 15% and 35% by weight of catalytic metal relative to a weight of the support.

48. (original) The method according to claim 42 wherein at least one of the precursors is introduced using a technique selected from the group consisting of incipient wetness impregnation, melt impregnation and coprecipitation.

49. (original) The method according to claim 42 wherein the at least one cocatalytic metal precursor in step (b) comprises at least one metal of Groups IIIA, IVA, VA, VIA, VIIA, VIIIA, IB and IIB.

50. (original) The method according to claim 42 wherein the at least one cocatalytic metal precursor in step (b) comprises at least one metal selected from the group consisting of ruthenium, hafnium, cerium, copper, thorium, zirconium, rhenium and titanium.

51. (original) The method according to claim 42 wherein the at least one cocatalytic metal precursor in step (b) is added in an amount sufficient for delivering an amount of cocatalytic metal to the catalyst-impregnated support that is between 0.001% and 20% by weight of the cocatalytic metal relative to a weight of the support.

52. (original) The method according to claim 42 wherein the at least one cocatalytic metal precursor in step (b) is added in an amount sufficient for delivering an amount of cocatalytic metal to the catalyst-impregnated support that is between 0.005% and 10% by weight of the cocatalytic metal relative to a weight of the support.

53. (original) The method according to claim 42 wherein the at least one cocatalytic metal precursor in step (b) is added in an amount sufficient for delivering an amount of cocatalytic

metal to the catalyst-impregnated support that is between 0.01% and 5% by weight of the cocatalytic metal relative to a weight of the support.

54. (original) The method according to claim 42 wherein the at least one promoter precursor in step (c) comprises at least one element selected from Groups IA, IIA, IIIB, IVB, VB, VIB and VIIB.

55. (original) The method according to claim 42 wherein the at least one promoter precursor in step (c) comprises at least one element selected from boron, palladium, platinum, silver, gold, nickel, copper, the alkali metals, the alkaline earth metals, the actinides and the lanthanides.

56. (original) The method according to claim 42 wherein the at least one promoter precursor in step (c) comprises boron.

57. (original) The method according to claim 42 wherein the at least one promoter precursor in step (c) is added in an amount sufficient for delivering an amount of promoter to the stabilized transition alumina catalyst support that is between 0.005% and 20% by weight of the promoter relative to a weight of the support.

58. (original) The method according to claim 42 wherein the at least one promoter precursor in step (c) is added in an amount sufficient for delivering an amount of promoter to the stabilized transition alumina catalyst support that is between 0.01% and 10% by weight of the promoter relative to a weight of the support.

59. (original) The method according to claim 42 wherein the at least one promoter precursor in step (c) is added in an amount sufficient for delivering an amount of promoter to the stabilized transition alumina catalyst support that is between 0.02% and 5% by weight of the promoter relative to a weight of the support.

60. (original) The method according to claim 42 wherein the effective conditions of step (e)

comprise a temperature between 200° C and 500° C.

61. (original) The method according to claim 42 wherein the effective conditions of step (e) comprise a temperature between 300°C and 400° C.

62. (original) The method according to claim 42 wherein the effective conditions of step (e) comprise a pressure between 1 atm and 10 atm.

63. (original) The method according to claim 42 wherein the effective conditions of step (e) comprise a pressure between 1 atm and 5 atm.

64. (original) The method according to claim 42 wherein the effective conditions of step (e) comprise a pressure of 1 atm.

65. (original) The method according to claim 42 wherein at least one of steps (a), (b), (c), (d), and (e) is executed more than once.

66. (original) The method according to claim 42 wherein any combination of steps (a), (b) and (c) are executed concurrently.

67. (original) The method according to claim 42 wherein step (c) is carried out simultaneous with step (a).

68. (original) The method according to claim 42 wherein step (c) is carried out simultaneous with step (b).

69. (original) The method according to claim 42 wherein step (b) is carried out more than once.

70. (currently amended) A process for producing a product mixture comprising paraffinic hydrocarbons, comprising:

contacting a reactant gas mixture comprising synthesis gas with a catalyst under conditions and in a reactor effective for at least partially transforming the synthesis gas to the product mixture, wherein the catalyst comprises

a stabilized transition alumina catalyst support comprising a γ -Al₂O₃ phase and a pore volume between 0.2 cm³/g and 0.6 cm³/g,

at least one catalytic metal;

optionally at least one cocatalytic metal;

and optionally at least one promoter,

wherein the stabilized transition alumina catalyst support is characterized by the presence of at least one structural stabilizer selected from the group consisting of boron, magnesium, silicon, calcium, titanium, chromium, manganese, iron, cobalt, nickel, copper, zinc, gallium, strontium, zirconium, barium, selenium and the lanthanides, including lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium, and further

wherein the stabilized transition alumina catalyst support is made by a method comprising steaming a transition alumina comprising a phase selected from the group consisting of γ -Al₂O₃, δ -Al₂O₃, θ -Al₂O₃ and any combination thereof at conditions comprising a temperature between 180° C and 300° C sufficient to transform it to at least partially transform said transition alumina to at least one phase selected from the group consisting of boehmite, pseudoboehmite, and combination thereof, and to form a boehmite material, said steaming step being carried out before or after the incorporation impregnation of [[the]] a structural stabilizer precursor, whereby a stabilizer-containing boehmite alumina is generated, and then calcining the stabilizer-containing boehmite alumina at a temperature between 400° C and 900° C to yield the said stabilized transition alumina catalyst support.

71-72. (canceled)

73. (previously presented) The method according to claim 42 wherein the catalyst is effective for converting synthesis gas to produce the product mixture having an alpha value of at least 0.85.

74. (previously presented) The method according to claim 42 wherein the catalyst is effective for converting synthesis gas to produce a product mixture comprising primarily hydrocarbons of at least 5 carbon atoms.

75. (canceled)

76. (previously presented) The method according to claim 42 wherein the transition alumina comprises a γ -Al₂O₃ phase.

77. (currently amended) The method according to claim 42 wherein the stabilized transition alumina further comprises a phase selected from the group consisting of γ -Al₂O₃, δ -Al₂O₃, θ -Al₂O₃ and any combination thereof.

78. (canceled)

79. (previously presented) The method according to claim 42 wherein the at least one structural stabilizer precursor comprises at least one element selected from the group consisting of boron, magnesium, silicon, calcium, titanium, chromium, manganese, iron, cobalt, nickel, copper, zinc, gallium, strontium, zirconium, barium, selenium and the lanthanides, including lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium.

80. (previously presented) The method according to claim 42 wherein the at least one structural stabilizer precursor comprises at least one element selected from the group consisting of boron, cobalt, zirconium and combinations thereof.

81. (previously presented) The method according to claim 42 wherein at least two structural stabilizer precursors are introduced to the transition alumina.

82. (previously presented) The method according to claim 42 wherein the at least one structural stabilizer precursor is introduced in a manner and an amount effective for delivering an amount of structural stabilizer precursor between 0.1% and 20% by weight of structural stabilizer precursor relative to a final weight of the stabilized transition alumina.

83. (previously presented) The method according to claim 42 wherein the at least one structural stabilizer precursor is introduced in a manner and an amount effective for delivering an amount of structural stabilizer precursor between 1% and 10% by weight of structural stabilizer precursor relative to the final weight of a stabilized transition alumina.

84. (previously presented) The method according to claim 42 wherein the at least one structural stabilizer precursor is introduced in a manner and an amount effective for delivering an amount of structural stabilizer precursor between 1% and 5% by weight of structural stabilizer precursor relative to a final weight of the stabilized transition alumina.

85. (canceled)

86. (previously presented) The method according to claim 42 wherein the making of the catalyst support further includes drying the stabilizer-impregnated alumina, and wherein said drying step is carried out at a temperature between 50 °C and 200 °C.

87-88. (canceled)

89. (previously presented) The method according to claim 42 wherein the sufficient conditions of steaming step (i) comprise a water vapor partial pressure between 1 bar and 5 bars.

90. (previously presented) The method according to claim 42 wherein the sufficient conditions of steaming step (i) comprise a water vapor partial pressure between 2 bars and 4 bars.

91-92. (canceled)

93. (new) The process according to claim 70 wherein the process is effective for producing the product mixture having an alpha value of at least 0.85.

94. (new) The process according to claim 70 wherein the process is effective for producing a product mixture comprising primarily hydrocarbons of at least 5 carbon atoms.

95. (new) The method according to claim 1 further comprising calcining the boehmite alumina after the steaming step (a) at a temperature ranging from about 250 °C to about 350 °C.

96. (new) The method according to claim 1 wherein the at least one structural stabilizer precursor comprises cobalt.

97. (new) The method according to claim 1 wherein the at least one structural stabilizer precursor comprises zirconium.

98. (new) The method according to claim 1 wherein the steaming step (c) is carried out for an interval of time from 0.5 hour to 4 hours.

99. (new) The method according to claim 20 wherein the steaming step (a) is carried out for an interval of time from 0.5 hour to 4 hours.

100. (new) The method according to claim 20 wherein the at least one structural stabilizer

precursor comprises cobalt.

101. (new) The method according to claim 42 wherein the steaming step (i) is carried out for an interval of time from 0.5 hour to 4 hours.